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Effect of composting on reducing the abundance of tetracycline-resistant genes in cow manure

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© SGEM2018. All rights reserved. Wastes from livestock farms contain significant amounts of antibacterial drugs and antibiotic–resistant genes. Due to weak adsorption in the animal's body, antibiotics are released into the environment in an unchanged form or as metabolites in the composition of manure. In addition to the antibacterial agents, the manure of treated animals contains antibiotic–resistant bacteria. The use of manure in untreated form as a soil fertilizer can lead to the spread of antibiotic resistance among soil microorganisms. Composting is an effective way to reduce the content of antibiotic–resistant genes in manure. In this paper, the effect of the composting of cow manure contaminated with different concentrations of oxytetracycline on the temporal change in the number of two tetracycline–resistant genes tet(M) and tet(X) was evaluated. The initial concentrations of oxytetracycline in the cow manure were 50 mg kg–1, 150 mg kg–1 and 300 mg kg–1. Composts mixtures were incubated for 4 months. The number of copies of tet(M) and tet(X) genes was evaluated by the real–time PCR method using specific primers. It was found that the introduction of oxytetracycline in manure leads to an increase in the level of resistant genes tet(M) and tet(X). The higher the dose of antibiotic, the more genes were found. With the passage of time of the composting process, the content of resistant genes decreases. On the 75th day, resistant genes were not found in all samples of compost mixtures.

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Keywords

Antibiotic resistance, Antibiotic-resistant genes, Composting, Manure, Oxytetracycline

References

[1] Dolliver H., Noll S. L., Antibiotic degradation during manure composting. Journal of Environmental Quality, vol. 37, pp 1245–1253, 2008.

[2] ISO 17601:2016 Soil quality — Estimation of abundance of selected microbial gene sequences by quantitative PCR from DNA directly extracted from soil.–2016

[3] Qian X., Sun W., Gu J., Wang X. J., Sun J. J., Yin Y. N., Duan M. L., Variable effects of oxytetracycline on antibiotic resistance gene abundance and the bacterial community during aerobic composting of cow manure. Journal of Hazardous Materials, vol. 315, pp 61–69, 2016.

[4] Selvam A., Xu D., Zhao Z., Wong J. W. C., Fate of tetracycline, sulfonamide and fluoroquinolone resistance genes and the changes in bacterial diversity during composting of swine manure. Bioresource Technology, vol. 126, pp 383–390, 2012.

[5] Sharma V. K., Johnson N., Cizmas L., Mcdonald T. J., Kim H., A review of the influence of treatment strategies on antibiotic resistant bacteria and antibiotic resistance genes. Chemosphere, vol. 150, pp 702–714, 2016.

[6] Sommer M. O. A., Dantas G., Antibiotics and the resistant microbiome. Current Opinion in Microbiology, vol. 14, pp 556–563, 2011.

[7] Su J. Q., Wei B., Xu C.Y., Qiao M., Zhu Y. G., Functional metagenomic characterization of antibiotic resistance genes in agricultural soils from China. Environment International, vol. 65, pp 9–15, 2014.

[8] Xie W.Y., Shen Q., Zhao F. J., Antibiotics and antibiotic resistance from animal manures to soil: a review. European Journal of Soil Science, vol. 47, pp 1–15, 2017.

[9] Xie W.Y., Yang X. P., Li Q., Wu L. H., Shen Q. R., Zhao F. J., Changes in antibiotic concentrations and antibiotic resistome during commercial composting of animal manures. Environmental Pollution, vol. 219, pp 182–190, 2016.

[10] Zhang T., Zhang M., Zhang, X., Fang H. H., Tetracycline Resistance Genes and Tetracycline Resistant Lactose-Fermenting Enterobacteriaceae in Activated Sludge of Sewage Treatment Plants Environmental Science & Technology, vol. 37, pp 3455– 3460, 2009.